

ABSTRACT

Many docks are put in the water at the start of the summer and then taken out of the water in the fall to avoid damage from freezing water conditions. Typically, this is a manual process requiring a crew of 2-4 people to uninstall, lift, and transport the heavy dock sections. This can be expensive when owners need to contract a crew to complete the work, so the design team was tasked with creating a tool to install and remove sections. The tool must meet target specifications while incorporating portability, stowability, and ease of assembly. Through brainstorming, meetings with the project sponsor, testing and implementation, the team designed a tool that simplifies the processes. Dock is lifted vertically, flipped, and rolled to shore while reducing size and weight from previous designs.



Figure 1 – Sponsor's Dock

CUSTOMER NEEDS/SPECS

Below are the customer needs and specifications in Table 1. The items highlighted in blue were met by the team's final design.

Table 1 – Customer Needs Met and Specifications

Customer Needs	Design Specifications
Portable	Lift capacity = 150 lb
Cost-effective	All-terrain wheels
Operable by 1-2 users	Cost < \$1500
Install/remove sponsor's dock	Pin to lock rotating component
Easy to assemble	Adjustable height range
Rotates dock 180 deg.	
Stowable	

DESIGN CONCEPTS

As a team, multiple concepts were created using the team's understanding of Mr. Hauguel's needs. The team's initial developed concept is shown in Figures 2-3 showcases a cart design along with a rotisserie jig. After reviewing the concept, the team and sponsor re-routed the design away from a cart. The team began re-design work that developed into a scope change. The team's new focus was to develop a lake-side component solely to install and remove the sponsor's dock.

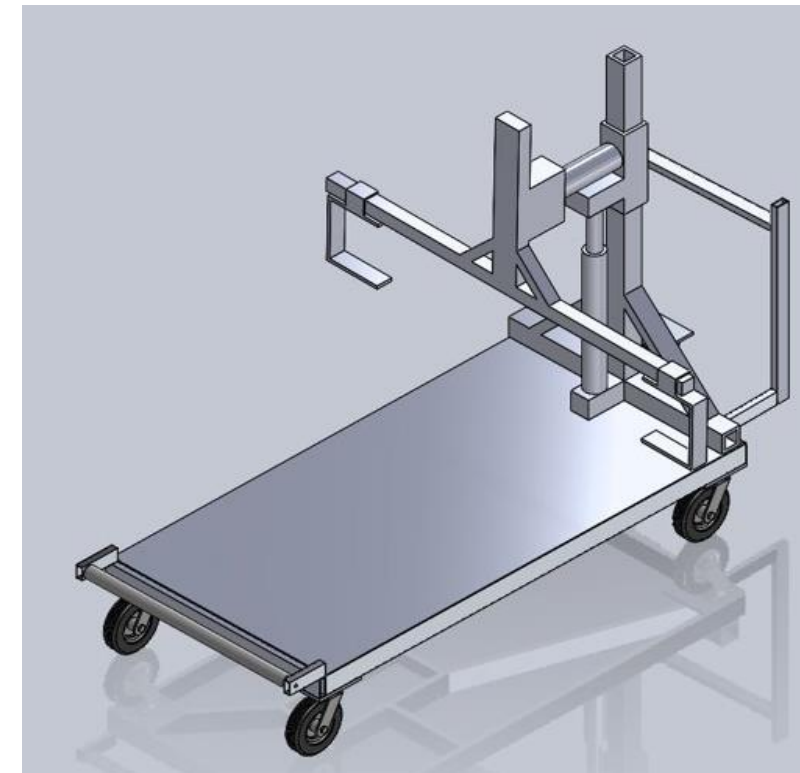


Figure 2 – Cart Concept with Jig (Shore)

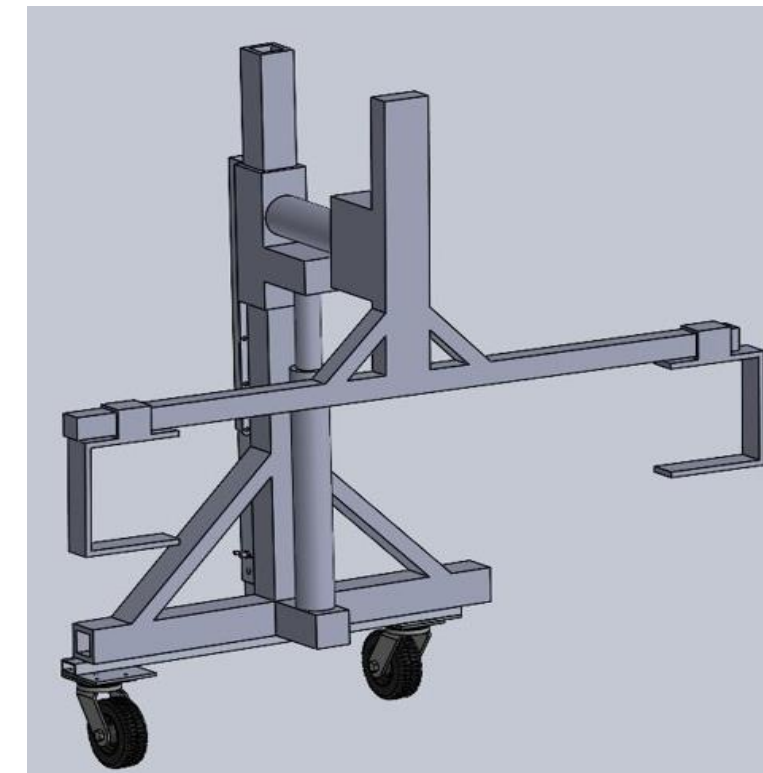


Figure 3 – Jig with Boat Jack (Lake)

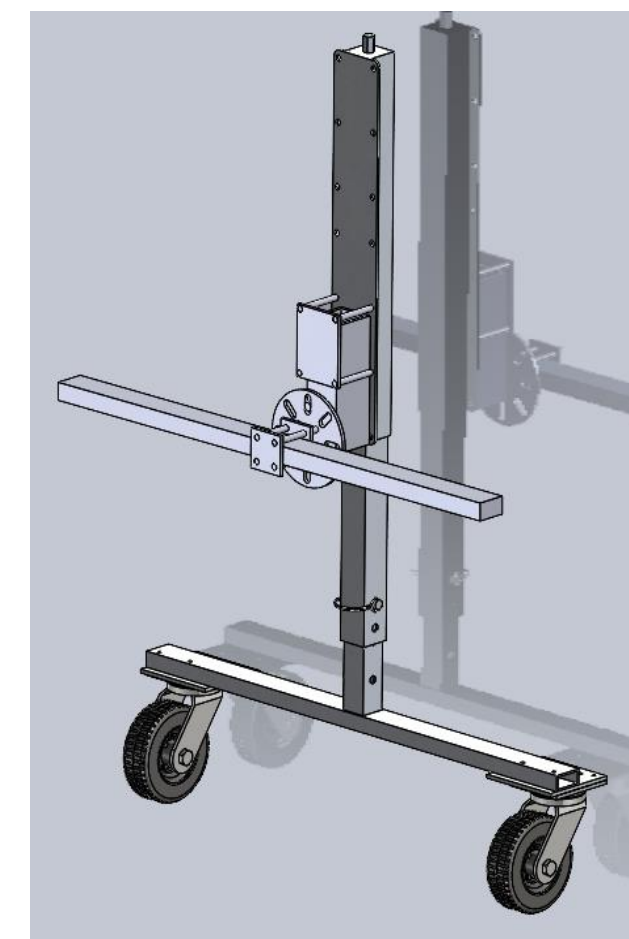


Figure 4 – Compact Rotisserie Bracket Concept

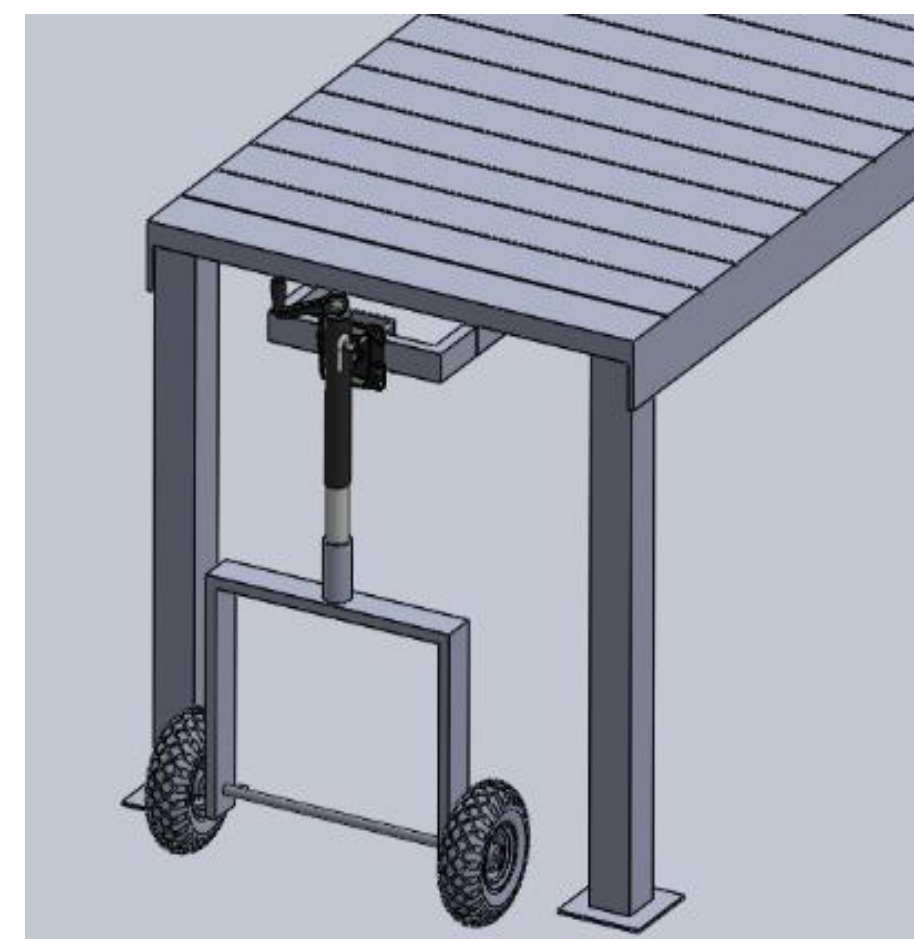


Figure 5 – Trailer Valet Concept Inserted into Stringers

Figure 4 shows a lake-side concept utilizing a bracket and crossbar. Ultimately, the team and sponsor determined that the strongest connection was a fork design that slides into the dock stringers shown in Figures 5 and 6.

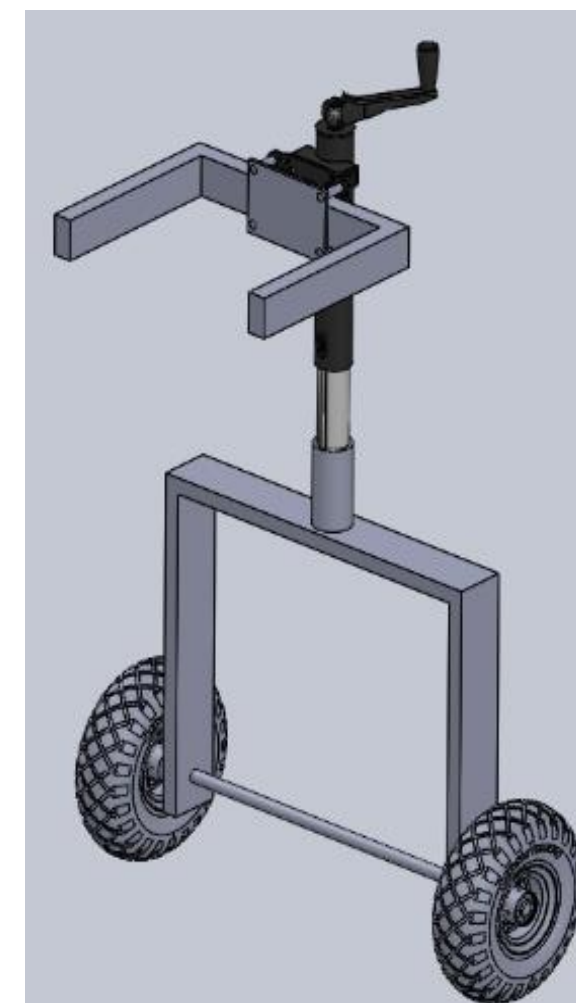


Figure 6 – Trailer Valet, Rotating Concept

TEST RESULTS

The team successfully rolled dock sections out, shown in Figure 7. The lakeside tool is shown on the left; the aluminum forks slide into the dock stringers.



Figure 7 – Dock Transport

Figure 8 shows the dock rotating with the team assisting. The rotation was smooth and did not catch. The wheels rolled steadily underwater.



Figure 8 - Dock Rotation

FINAL DESIGN

The final design shown in Figures 9 and 10 was derived from concepts made throughout the project. This includes:

- Multiple components for ease of assembly and storage
- Adjustable heights from 31"-46" with an optional 12" extension increase
- Frame height reduction of 5" to better incorporate shorter sections



Figure 9 – Final Design Side View



Figure 10 – Final Design Front View

CONCLUSION

The team followed a set phase schedule to create a tool to assist in the removal and installation of dock sections for Mr. Jim Hauguel. The tool is compact, simple to use, and presents a great concept for further development. The team was unable to complete a shore side component due to the scope change, thus, an opportunity for more development could be available.

LESSONS LEARNED

The team learned many things throughout the course of this project.

- Communication is paramount in a detailed design process as components are constantly being adjusted or changed. The design process is shown in Figure 10.
- Scheduling is very important to ensure deadlines are met and timelines for the project are understood by all involved.
- Don't have your mind set on one thing, being open to change and adaptability keeps the group less stressed.

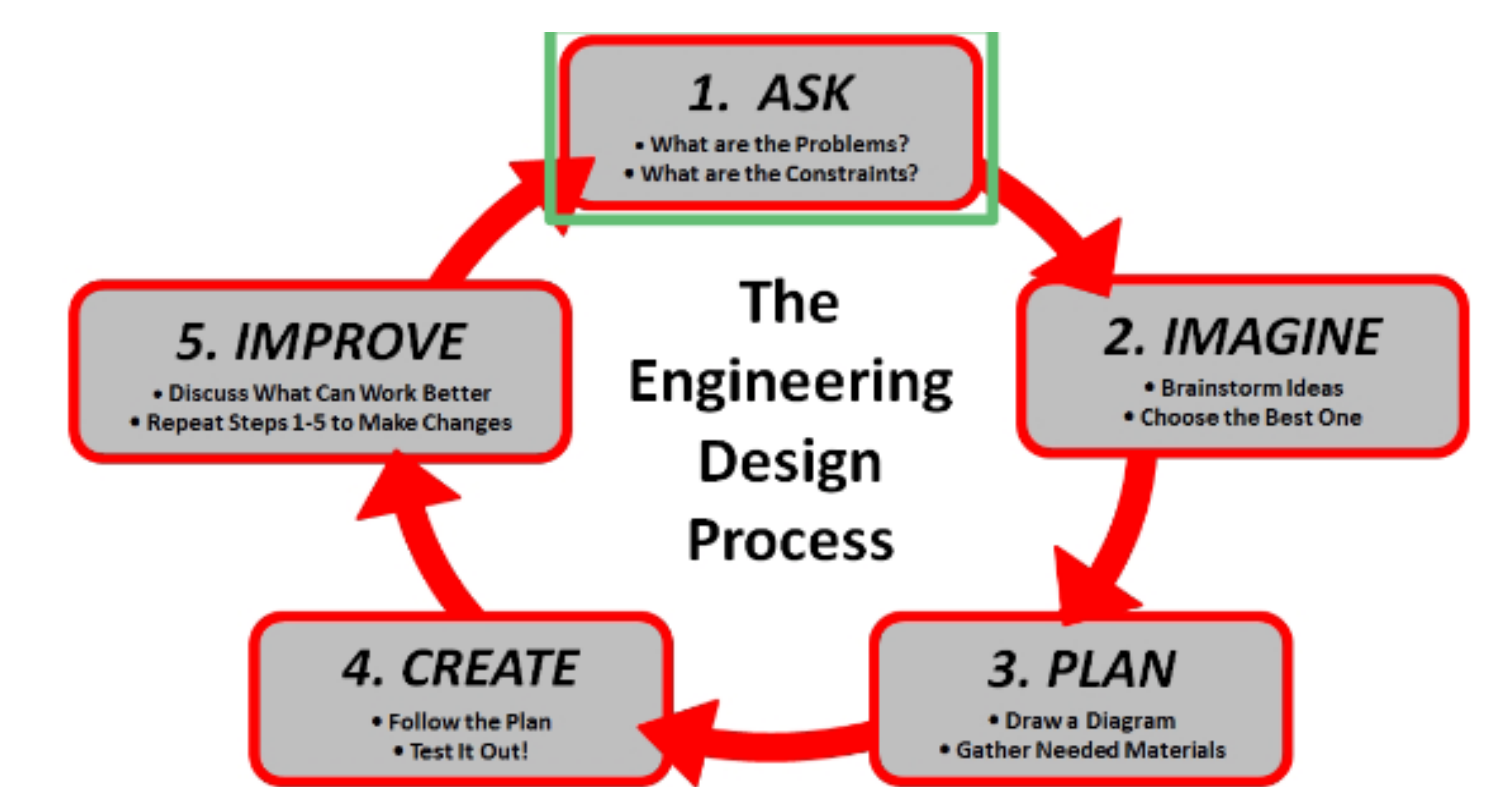


Figure 10: Engineering Design Process

ACKNOWLEDGEMENTS

The team would like to acknowledge the following people for helping with the completion of this project:

- **Jim Hauguel**, Sponsor, E.O. Snell, LLC
- **Rod Higbee**, Higbee Welding in Fremont, IN, for his donation of time, labor, and excellent fabrication for the team
- **Timerson Downing**, Trine University Innovation One